A Holistic Model Of Atmospheric Corrosion

Ivan Cole,[1] Scott Furman,[1] Wayne Ganther,[1]
Deborah Lau,[1] Aaron Neufeld,[1] David Paterson[1] and
Gerry Trinidad[1]

[1]CSIRO
P.O.Box56, Graham Rd
Highett, Vic 3190
Australia

Atmospheric Corrosion is controlled by processing at the macro, meso, local , micro and micron level . Recent experience has demonstrated that parametric models are too limited to contain the full variation in influences on corrosion on a global scale and thus a holistic approach to corrosion must be adapted in which models on different dimensional scales are linked together. In this context macro refers to gross meteorological conditions (polar, sub-tropical etc.), meso refers to regions with dimensions up to 100 km, local is in the immediate vicinity of a building, while micro refers to the absolute proximity of a material surface. Micron then refers to interactions within the metal/oxide/electrolyte interfaces. The development of such a holistic model is significant task and remains very much a work in progress. However progress has been made in

A) Developing a GIS (geographical information system) which incorporates meso macro and local process controlling climate and pollutant distribution. B) The micro level refers both to microclimate and to the response of the surface to that microclimate. Models controlling processes of pollutant deposition and moisture layer formation have been developed. Studies of pH variation and oxide formation under small drops have highlighted the interaction of electrochemical processes, oxide stability/dissolution and gas liquid interactions. C) At the micron level a stochastic engine has been constructed that simulates, electrochemical, mass transport and chemical process and maps the development of a surfaces response to an imposed microclimatic condition.

These modeling developments are linked to detailed experimental program on similar scales so that atmospheric corrosion and climatic influences are being studied on a continental and regional scale (across South east Asia) whilst finescale work using the scanning Kelvin probe is providing direct experimental evidence on potential distributions and diffusion processes that occur on metal surfaces under fine salt drops.

The paper will link results from these scales together, outlining how the holistic approach provides insights that are not available when corrosion is studied through one discipline or on one scale